



tech briefs

Westinghouse Savannah River Company

Surface Plasmon Resonance Probe

at a glance

Stable and robust

High resolution

Low noise

U.S. Patent 6,466,323

for more information

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All optical chemical sensor enables remote measurements

Scientists at the Westinghouse Savannah River Company (WSRC) have developed a novel surface plasmon resonance (SPR) probe sensor that enables remote chemical measurements in a stable, robust probe format.

Background

SPR is an optical phenomenon that enables detection of molecules adhering to a surface. SPR is often detected as a loss in reflected light intensity at a specific frequency or wavelength of light, as the incident light energy is coupled into the surface plasmon wave. The wavelength dependence of this intensity loss is analyzed and can be used to quantitatively determine the molecular adsorption on the surface of the SPR active material. Most SPR experiments are performed using expensive benchtop instruments with bulky optical components, making SPR difficult to employ in remote sensing applications.

The process

The WSRC SPR sensor enables remote SPR measurements in a stable, robust probe format, consisting of a commercially available attenuated total reflection (ATR) probe modified to support SPR. Thin layers of gold and silica are deposited on the curved apex of the ATR hemispherical lens. This modified probe allows for sensitive detection of gas molecules as they adsorb onto the silica surface.

The use of the hemispherical ATR probe as the starting optics allows for the sensor to be placed at the end of a fiber optic cable that carries both the incident light and the reflected signal back to the measuring instrument. The curvature of the hemisphere compensates for the divergence of the source fiber and refocuses the light back to a collection fiber. This fiber optic SPR probe has been shown to produce extremely high resolution, low noise SPR spectra typical of expensive benchtop systems.

The WSRC SPR sensor probe is extremely sensitive to water vapor adsorption onto the probe surface. It has been applied to atmospheric moisture monitoring and has shown sub-ppm sensitivity over a range of ~0 to 100% relative humidity (0 to >20,000 ppm at 25°C, 1 atm).



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Potential Applications

Although the current probe is configured as a moisture sensor, the technology, using different materials, is applicable to measurement of any gas phase species that can condense on the probe tip from some equilibrium concentration in the gas phase. The probe is especially useful in an environment where an electrical measurement is undesirable, or where there is electrical noise interference.

In an alternate configuration, the SPR sensor can be used to make highly accurate measurements of the refractive index of a liquid.

Partnering opportunity

U.S. Patent 6,466,323 has been issued on this invention.

Westinghouse Savannah River Company (WSRC) invites interested companies with proven capabilities in this area of expertise to enter into a licensing agreement with WSRC to manufacture and market this device as a commercial product. Interested companies will be requested to submit a business plan setting forth company qualifications, strategies, activities, and milestones for commercializing this invention. Qualifications should include past experience at bringing similar products to market, reasonable schedule for product launch, sufficient manufacturing capacity, established distribution networks, and evidence of sufficient financial resources for product development and launch.

Technology transfer

WSRC is the managing contractor of the Savannah River Site for the U.S. Department of Energy. WSRC scientists and researchers develop technologies designed to improve environmental quality, support international nonproliferation, dispose of legacy wastes, and provide clean energy sources.

WSRC is responsible for transferring technologies to the private sector so that these technologies may have the collateral benefit of enhancing U.S. economic competitiveness.

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